Title: **DATA STORAGE DISK CAPABLE OF LIMITING EXTENSION OF CRACK**

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Cross Reference to Related Applications

[0001] This application claims priority to Taiwan Patent Application No. 091134056 entitled "Anti-Crack Data Storage Disk", filed November 22, 2002.

Field of Invention

[0002] The present invention generally relates to a data storage disk, and more particularly, to a data storage disk capable of limiting breakage caused by a crack during operation in a disk driver.

Background of the Invention

[0003] Recently, the revolution per minute (RPM) of a spindle motor in a disk driver has been continuously increased due to the increase of information-recording density of the data storage disk. However, problems regarding the high-speed spin of the data storage disk have been exposed, for example, the increase in breakage of the disk during operation, and most seriously, injuries caused by cracked disks flying out of the disk driver. Therefore, to design a disk capable of limiting breakage is the focus of development in the industry.

[0004] Fig. 1 illustrates a conventional disk. It is known by those skilled in the art that when the disk spins at a high speed, the disk has a highest stress in the inner edge 103. Therefore, a crack is generally generated on the inner edge and advances to the outer edge 101.

[0005] When the crack generated in the disk reaches the critical crack length, the advance of the crack increases substantially to make the disk break. It is also known that as the spin speed increases the critical crack length decreases.

[0006] The commercial high-speed disk driver generally has a speed of 48x or 52x. According to David Nowell's experiments and theory, when the speed is 48x, the critical crack length is about 1.72 cm; when calculating by the destructive mechanics, the theoretical critical crack length becomes about 0.83 cm, which is about one half of the experimental value. When the speed is 52x, the experimental critical crack length is about 1.25 cm, and the theoretical critical crack length is about 0.6 cm, which is about one half of the experimental value. The factors of differences between experimental and theoretical values have been discussed in David Nowell's article and will not be elaborated herein.

[0007] Therefore, there is a need to provide a disk suitable for operating at a high spin speed and capable of hindering a crack from advancing over the experimental critical crack length.

Summary of the Invention

[0008] It is one aspect of the present invention to provide a data storage disk capable of limiting breakage caused by a crack during operation in a disk driver.

[0009] It is another aspect of the present invention to provide a data storage disk suitable for use in a high-speed disk driver.

[0010] In an exemplary embodiment, the present invention provides a data storage disk having a gravity center, an outer edge, an inner edge, and at least one slot disposed between the outer edge and the inner edge. When a crack occurs in the data storage disk, the slot disperses a stress which forces the crack to extend. Therefore, the slot hinders an

extension to the crack from extending to the outer edge so as to keep the crack under the critical crack length and prevent breakage of the disk.

[0011] The data storage disk further includes a data storage region for recording information. The data storage region is arranged between the outer edge and the inner edge, and the slot is disposed between the data storage region and the inner edge.

[0012] In one embodiment, multiple slots are formed on the data storage disk. A geometry center of these slots coincides with the gravity center of the data storage disk. Furthermore, the slots is thus configured that a straight normal line drawn from the center toward any point at the outer edge intersects with at least one of the slots. Therefore, a crack generated on the inner edge is effectively hindered from advancing to the outer edge.

Brief Description of the Drawings

[0013] The foregoing aspects and many of the attendant advantages of this invention will become more readily appreciated as the same becomes better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

[0014] Fig. 1 illustrates a conventional data storage disk;

[0015] Fig. 2A illustrates a data storage disk in a first embodiment of the present invention;

[0016] Fig. 2B illustrates a data storage disk in a second embodiment of the present invention;

[0017] Fig. 3A illustrates exemplary slots disposed between the data storage region and the inner edge;

[0018] Fig. 3B illustrates exemplary slots disposed in the data storage region;

[0019] Fig. 3C illustrates exemplary slots disposed between the data storage region and the outer edge;

[0020] Fig. 4 illustrates a data storage disk in a third embodiment of the present invention;

[0021] Fig. 5 illustrates a data storage disk in a fourth embodiment of the present invention; and

[0022] Fig. 6 illustrates a data storage disk in a fifth embodiment of the present invention.

Detailed Description of the Invention

[0023] The present invention provides a data storage disk 100, which is capable of limiting breakage caused by a crack during operation in a disk driver. The data storage disk 100 can be any disk for storing information, such as video compact disk (VCD), digital-video-disk (DVD), mini disk, or the like.

[0024] Fig. 2A illustrates an exemplary data storage disk 100 of the present invention. As shown in Fig. 2A, the data storage disk 100 has a center 400, an outer edge 101, an inner edge 103, and at least one slot 200. The slot 200 is disposed between the outer edge 101 and the inner edge 103. In a preferred embodiment, the maximum distance "d" (not shown) between one of the slots 200 and the inner edge 103 is less than 1.25 cm.

[0025] It is noted that though six slots 200 are shown in Fig. 2A, the number of slots 200 is not limited thereto. For example, four slots 200 are illustrated in Fig. 2B.

[0026] As shown in Fig. 2A, the slot 200 defines an inner rim 201 of a smooth close loop. In other words, the inner rim 201 has no angled or sharp point so as to prevent stress from concentrating on the point where a crack might be induced when a force is exerted on the data storage disk 100.

[0027] When a crack occurs in the data storage disk 100, it generally advances toward the outer edge 101. When the crack advances to the slot 200, the stress of forcing the crack to

advance is dispersed to the inner rim 201 of the slot 200. In other words, the slot 200 effectively hinders further extension of the crack and keeps the crack under the critical crack length so as to prevent breakage of the disk 100.

[0028] When the data storage disk 100 is operated, the crack is generally generated on the inner edge 103 and advances toward the outer edge 101 because the stress is higher around the inner edge 103. In a preferred embodiment, the maximum distance "d" between one of the slots 200 and the inner edge 103 is less than 1.25 cm to ensure that the crack remains under the critical crack length when spinning under a high speed, such as 52x.

[0029] As shown in Fig. 3A, the data storage disk 100 further includes a data storage region 303 for storing data. The data storage region 303 is arranged between the outer edge 101 and the inner edge 103. In this embodiment, the slot 200 is disposed between the data storage region 303 and the inner edge 103. In other embodiments, the slot 200 can be disposed within the data storage region 302 or between the data storage region 303 and the outer edge 101, as shown in Figs. 3B and 3C, respectively.

[0030] As shown in Fig. 3A, the exemplary data storage disk also includes a center hollow portion 301 and a non-recording portion 305. The center hollow portion 301 surrounded by the inner edge 103 is a hole around the center 400 of the disk. The data storage disk 100 engages with the disk driver by a spindle passing through the center hollow portion 301. In this embodiment, the center hollow portion 301 is a hole in a round shape; however, the center hollow portion can be in other shapes such as square, oval, or the like, and is not limited thereto.

[0031] The non-recording portion 305 is disposed between the center hollow portion 301 and the data storage region 303. The disk driver holds the non-recording portion 305 so as to provide a driving force for spinning the data storage disk 100. The slot can be disposed

in the non-recording portion 305 and hinder the crack from advancing to the outer edge 101 so as to prevent the breakage of the data storage disk 100.

[0032] As shown from Fig. 2A to Fig. 3B, the slot is in a curved shape. Multiple slots 200 are disposed circumferentially around the center 400 of the data storage disk 100. In such arrangement, the slots 200 are arranged around the center 400 in a configuration similar to the rotation direction of the data storage disk 100. However, in other embodiments, the slots 200 can be in a different shape, for example, in bar shape as shown in Fig. 4.

[0033] As shown from Fig. 2A to Fig. 3B, the data storage disk 100 has a center 400, and the center 400 can be the center of mass, center of rotation, center of geometry, or other physically or geometrically defined center. The slots 200 are in a curved shape, and the center of the slots 200 is coincided with the center 400 of the data storage disk 100 as shown from Fig. 2A to Fig. 4.

[0034] In addition, the slots 200 can be asymmetrically disposed around the center 400 as shown in Figs. 5 and 6. It is noted that the center of geometry of slots 200 is not required to coincide with the center 400 of the data storage disk 100. As shown in Fig. 6, the center of geometry of slots 200 does not coincide with the center 400 of the data storage disk 100. By adjusting the center of gravity of the data storage disk 100, it still can maintain the balance when spinning at a high speed.

[0035] As shown from Fig. 2A to Fig. 3B, a straight normal line drawn from the center 400 or any point at the inner edge 103 toward any point at the outer edge 101 intersects with at least one of the slots 200. In such arrangement, the slots 200 can effectively hinder most cracks generated on the inner edge 103 from advancing to the outer edge 101.

[0036] Although specific embodiments have been illustrated and described, it will be obvious to those skilled in the art that various modifications may be made without departing from what is intended to be limited solely by the appended claims.